
Appendix A

Additional Monitoring Results for 1997

Appendix A

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G. W. Patton and T. M. Poston

This appendix contains additional information on 1997 monitoring results, supplementing the data summarized

in the main body of the report. More detailed information is available in PNNL-11796.

Table A.1. Radionuclide Concentrations in Columbia River Water at Priest Rapids Dam, 1997 Compared to Previous 5 Years

Radionuclide ^(a)	No. of Samples	1997		No. of Samples	1992-1996		Ambient Surface Water Quality Standard, pCi/L
		Maximum	Average		Maximum	Average	
Composite System							
Alpha (gross)	12	0.82 ± 0.55	0.35 ± 0.076	60	1.2 ± 0.90	0.41 ± 0.046	15 ^(c,d)
Beryllium-7	12	11 ± 26	2.8 ± 1.9	60	18 ± 15	2.2 ± 1.0	6,000 ^(e)
Beta (gross)	12	3.2 ± 1.8	0.36 ± 0.40	60	3.5 ± 2.4	1.0 ± 0.15	50 ^(c,d)
Cobalt-60	12	1.5 ± 1.3	0.11 ± 0.26	60	1.6 ± 0.99	-0.024 ± 0.12	100 ^(e)
Cesium-134	12	2.8 ± 2.4	0.50 ± 0.39	60	1.4 ± 1.0	-0.00099 ± 0.084	20,000 ^(e)
Cesium-137	12	2.0 ± 2.3	0.38 ± 0.35	60	1.2 ± 1.7	0.13 ± 0.066	200 ^(e)
Europium-154	12	4.6 ± 3.3	-1.2 ± 1.0	60	5.2 ± 2.9	0.42 ± 0.26	200 ^(e)
Europium-155	12	5.8 ± 4.7	0.56 ± 0.78	60	3.5 ± 5.1	-0.012 ± 0.18	600 ^(e)
Potassium-40	12	190 ± 52	59 ± 15	60	280 ± 54	44 ± 5.5	-- ^(f)
Ruthenium-106	12	12 ± 22	2.4 ± 1.8	43	9.7 ± 8.8	-2.2 ± 1.1	30 ^(e)
Antimony-125	12	6.4 ± 5.6	-0.81 ± 0.91	43	3.2 ± 2.2	-0.44 ± 0.26	300 ^(e)
Strontium-90	12	0.13 ± 0.062	0.090 ± 0.0074	60	0.14 ± 0.0049	0.085 ± 0.0029	8 ^(c,d)
Technetium-99	12	1.6 ± 0.69	0.17 ± 0.14	60	0.65 ± 0.55	0.012 ± 0.026	900 ^(e)
Tritium	12	42 ± 9.4	28 ± 2.3	60	110 ± 16	38 ± 1.5	20,000 ^(e)
Uranium-234	12	0.36 ± 0.065	0.26 ± 0.012	60	0.44 ± 0.13	0.23 ± 0.0068	--
Uranium-235	12	0.015 ± 0.012	0.0075 ± 0.0012	60	0.032 ± 0.039	0.0093 ± 0.0010	--
Uranium-238	12	0.28 ± 0.054	0.22 ± 0.011	60	0.35 ± 0.11	0.18 ± 0.0055	--
Uranium (total)	12	0.64 ± 0.12	0.48 ± 0.022	60	0.83 ± 0.28	0.42 ± 0.012	--
Iodine-129 ^(g)	4	0.000010 ± 0.0000012	0.0000072 ± 0.0000012	20	0.00013 ± 0.000013	0.000017 ± 0.0000065	1 ^(e)
Continuous System							
Plutonium-230,240	P 4	0.00015 ± 0.000098	0.000079 ± 0.000048	20	0.000097 ± 0.000040	0.000025 ± 0.0000058	--
	D 4	0.000056 ± 0.00010	0.000018 ± 0.000030	20	0.00063 ± 0.00021	0.000063 ± 0.000033	--

(a) Radionuclides measured using the continuous system show the particulate (P) and dissolved (D) fractions separately. Other radionuclides are based on unfiltered samples collected by the composite system (see Section 4.2, "Surface Water and Sediment Surveillance").

(b) Maximum values are ± total propagated analytical uncertainty (2-sigma). Averages are ±2 standard error of the calculated mean.

(c) WAC 246-290.

(d) 40 CFR 141.

(e) WAC 173-201A-050 and EPA-570/9-76-003.

(f) Dashes indicate no concentration guides available.

(g) From 1992 through 1995, iodine-129 concentrations were obtained from the dissolved fraction of the continuous system.

Table A.2. Radionuclide Concentrations in Columbia River Water at the Richland Pumphouse, 1997 Compared to Previous 5 Years

Radionuclide ^(a)	1997			1992-1996			Ambient Surface Water Quality Standard, ^(c) pCi/L	
	No. of Samples	Maximum	Concentration, ^(b) pCi/L Average	No. of Samples	Maximum	Concentration, ^(b) pCi/L Average		
Composite System								
Alpha (gross)	12	2.2 ± 1.1	0.58 ± 0.16	60	1.7 ± 1.1	0.57 ± 0.057	15 ^(c,d)	
Beryllium-7	12	18 ± 23	1.4 ± 2.5	60	20 ± 12	1.7 ± 1.1	6,000 ^(e)	
Beta (gross)	12	2.6 ± 1.6	1.2 ± 0.21	60	3.4 ± 1.7	0.98 ± 0.13	50 ^(c,d)	
Cobalt-60	12	1.7 ± 2.1	0.16 ± 0.41	60	2.0 ± 1.1	0.018 ± 0.096	100 ^(e)	
Cesium-134	12	1.1 ± 1.2	-0.00026 ± 0.23	60	1.2 ± 0.89	-0.10 ± 0.091	20,000 ^(e)	
Cesium-137	12	3.7 ± 2.1	0.77 ± 0.35	60	1.6 ± 1.5	0.22 ± 0.083	200 ^(e)	
Europium-154	12	4.1 ± 3.4	-0.19 ± 0.75	60	4.3 ± 2.6	-0.052 ± 0.23	200 ^(e)	
Europium-155	12	3.4 ± 4.6	0.15 ± 0.76	60	3.5 ± 2.8	0.034 ± 0.16	600 ^(e)	
Potassium-40	12	240 ± 61	65 ± 19	60	100 ± 28	43 ± 2.9	-- ^(f)	
Ruthenium-106	12	13 ± 18	0.86 ± 2.6	43	18 ± 12	1.0 ± 0.96	30 ^(e)	
Antimony-125	12	6.0 ± 4.7	0.36 ± 0.66	43	3.9 ± 2.5	-0.032 ± 0.26	300 ^(e)	
Strontium-90	12	0.13 ± 0.048	0.082 ± 0.0057	60	0.30 ± 0.081	0.090 ± 0.0046	8 ^(c,d)	
Technetium-99	12	0.31 ± 0.56	0.094 ± 0.030	60	1.4 ± 0.71	0.042 ± 0.032	900 ^(e)	
Tritium	12	88 ± 13	61 ± 6.0	60	160 ± 20	87 ± 3.9	20,000 ^(d)	
Uranium-234	12	0.40 ± 0.075	0.29 ± 0.021	60	0.50 ± 0.13	0.27 ± 0.010	--	
Uranium-235	12	0.017 ± 0.014	0.0088 ± 0.0016	60	0.048 ± 0.022	0.010 ± 0.0012	--	
Uranium-238	12	0.29 ± 0.057	0.24 ± 0.011	60	0.53 ± 0.14	0.21 ± 0.0083	--	
Uranium (total)	12	0.70 ± 0.014	0.54 ± 0.030	60	1.0 ± 0.30	0.48 ± 0.018	--	
Iodine-129 ^(g)	4	0.00016 ± 0.000013	0.00012 ± 0.000028	17	0.00017 ± 0.000020	0.00010 ± 0.000010	1 ^(e)	
Continuous System								
Plutonium-239,240	P	4	0.00015 ± 0.000051	0.000081 ± 0.000048	17	0.000056 ± 0.000026	0.000019 ± 0.0000035	--
	D	4	0.000097 ± 0.00011	0.000039 ± 0.000041	17	0.000020 ± 0.000012	0.000050 ± 0.000013	--

- (a) Radionuclides measured using the continuous system show the particulate (P) and dissolved (D) fractions separately. Other radionuclides are based on unfiltered samples collected by the composite system (see Section 4.2, "Surface Water and Sediment Surveillance").
- (b) Maximum values are ± total propagated analytical uncertainty (2-sigma). Averages are ±2 standard error of the calculated mean.
- (c) WAC 246-290.
- (d) 40 CFR 141.
- (e) WAC 173-201A-050 and EPA-570/9-76-003.
- (f) Dashes indicate no concentration guides available.
- (g) From 1992 through 1995, iodine-129 concentrations were obtained from the dissolved fraction of the continuous system.

Table A.3. Radionuclide Concentrations Measured in Columbia River Water Along Transects of the Hanford Reach, 1997

Transect/Radionuclide	No. of Samples	Concentration, ^(a) pCi/L		
		Maximum	Minimum	Mean
Vernita Bridge				
Tritium	12	37 ± 9.1	23 ± 7.8	28 ± 1.1
Strontium-90	12	0.11 ± 0.038	0.057 ± 0.032	0.083 ± 0.0041
Uranium (total)	12	0.54 ± 0.14	0.42 ± 0.10	0.48 ± 0.010
100-N Area				
Tritium	5	32 ± 8.3	28 ± 8.1	30 ± 0.56
Strontium-90	5	0.16 ± 0.047	0.092 ± 0.038	0.12 ± 0.015
Uranium (total)	5	0.49 ± 0.12	0.40 ± 0.10	0.46 ± 0.017
100-F Area				
Tritium	10	30 ± 8.3	24 ± 8.1	27 ± 8.6
Strontium-90	10	0.10 ± 0.038	0.079 ± 0.034	0.088 ± 0.028
Uranium (total)	10	0.62 ± 0.13	0.36 ± 0.091	0.45 ± 0.14
Old Hanford Townsite				
Tritium	10	1,600 ± 140	25 ± 8.2	180 ± 150
Strontium-90	10	0.12 ± 0.041	0.067 ± 0.033	0.091 ± 0.0058
Uranium (total)	10	0.49 ± 0.12	0.38 ± 0.098	0.42 ± 0.011
300 Area				
Tritium	10	63 ± 11	27 ± 8.0	34 ± 3.5
Strontium-90	10	0.12 ± 0.043	0.084 ± 0.036	0.098 ± 0.0037
Uranium (total)	10	0.89 ± 0.16	0.42 ± 0.10	0.51 ± 0.044
Richland Pumphouse				
Tritium	31	71 ± 11	26 ± 8.3	35 ± 1.4
Strontium-90	31	0.12 ± 0.043	0.049 ± 0.029	0.085 ± 0.0026
Uranium (total)	31	0.73 ± 0.14	0.36 ± 0.090	0.50 ± 0.014

(a) Maximum and minimum values are ± total propagated analytical uncertainty (2-sigma). Mean values are ±2 standard error of the mean.

Table A.4. Selected U.S. Geological Survey Columbia River Water Quality Data,^(a) 1997

Analysis	Units	Vernita Bridge (upstream)				Richland Pumphouse (downstream)				Washington Ambient Surface Water Quality Standard ^(b)
		No. of Samples	Maximum	Median	Minimum	No. of Samples	Maximum	Median	Minimum	
Temperature	°C	11	19	12	3.0	4	20	11	4.5	20 (maximum)
Dissolved oxygen	mg/L	11	14	13	10	4	13	12	10	8 (minimum)
Turbidity	NTU ^(c)	11	4.7	1.9	0.30	4	3.5	1.0	0.30	5 + background
pH	pH units	11	8.1	7.9	7.4	4	7.9	7.9	7.8	6.5 - 8.5
Suspended solids, 105°C	mg/L	11	12	4.0	0.0	4	13	5.5	3.0	-- ^(d)
Dissolved solids, 180°C	mg/L	11	96	77	71	4	88	78	72	--
Specific conductance	µS/cm ^(e)	11	160	130	110	4	150	130	120	--
Total hardness, as CaCO ₃	mg/L	11	71	59	48	4	71	59	54	--
Phosphorus, total	mg/L	11	0.04	<0.01	<0.01	4	<0.01	<0.01	<0.01	--
Chromium, dissolved	µg/L	0	NR ^(f)	NR	NR	4	<1	<1	<1	--
Dissolved organic carbon	mg/L	11	3.6	1.9	1.1	4	2.3	1.6	1.3	--
Iron, dissolved	µg/L	11	66	13	<3	4	12	8.0	<3	--
Ammonia, dissolved, as N	mg/L	11	0.008	<0.002	<0.002	4	<0.02	<0.01	<0.01	--
Nitrogen, total Kjeldahl, as N	mg/L	11	0.1	<0.2	<0.2	4	<0.2	<0.2	<0.2	--
Nitrite + nitrate, dissolved, as N	mg/L	11	0.26	0.093	0.040	4	0.22	0.11	0.090	--

(a) Provisional data from U.S. Geological Survey National Stream Quality Accounting Network (NASQAN), subject to revision.

(b) From WAC 173-201A.

(c) NTU = nephelometric turbidity units.

(d) Dashes indicate no standard available.

(e) µSiemens/cm.

(f) NR = not reported.

Table A.5. Radionuclide Concentrations in Columbia River and Riverbank Spring Sediment, 1997 Compared to Previous 5 Years

Location	Radionuclide	No. of Samples	1997		No. of Samples	1992-1996	
			Maximum ^(a)	Median ^(b)		Maximum ^(a)	Median ^(b)
River Sediment							
100-F Slough	Cobalt-60	1	0.024 ± 0.013		6	0.033 ± 0.011	0.029
	Cesium-137	1	0.28 ± 0.036		6	0.76 ± 0.082	0.43
	Europium-155	1	0.061 ± 0.033		6	0.064 ± 0.048	0.028
	Plutonium-239,240	1	0.0020 ± 0.00047		6	0.0024 ± 0.00082	0.0015
	Strontium-90	1	0.0032 ± 0.0029		6	0.013 ± 0.0052	0.0033
	Uranium-235	1	0.064 ± 0.068		6	0.054 ± 0.068	0.0056
	Uranium-238	1	0.99 ± 0.33		6	1.4 ± 0.41	0.86
Hanford Slough	Cobalt-60	1	0.18 ± 0.028		6	0.32 ± 0.046	0.088
	Cesium-137	1	0.25 ± 0.036		6	0.59 ± 0.068	0.39
	Europium-155	1	0.068 ± 0.029		6	0.16 ± 0.077	0.080
	Plutonium-239,240	1	0.0037 ± 0.00083		6	0.0076 ± 0.0014	0.0040
	Strontium-90	1	0.010 ± 0.0052		6	0.017 ± 0.0052	0.0066
	Uranium-235	1	0.040 ± 0.077		6	0.24 ± 0.16	0.085
	Uranium-238	1	1.4 ± 0.43		6	2.4 ± 0.88	0.80
McNary Dam	Cobalt-60	4	0.054 ± 0.017	0.030	24	0.27 ± 0.065	0.073
	Cesium-137	4	0.34 ± 0.045	0.32	24	1.0 ± 0.11	0.48
	Europium-155	4	0.078 ± 0.040	0.048	24	0.13 ± 0.069	0.064
	Plutonium-239,240	4	0.0077 ± 0.0014	0.0068	24	0.014 ± 0.0026	0.0097
	Strontium-90	4	0.024 ± 0.0074	0.017	24	0.061 ± 0.014	0.025
	Uranium-235	4	0.21 ± 0.10	0.066	24	0.20 ± 0.16	0.066
	Uranium-238	4	1.9 ± 0.49	1.7	24	2.3 ± 0.71	1.4
Priest Rapids Dam	Cobalt-60	3	0.016 ± 0.010	0.0080	24	0.038 ± 0.049	0.0020
	Cesium-137	3	0.52 ± 0.060	0.034	24	1.0 ± 0.14	0.42
	Europium-155	3	0.057 ± 0.035	0.051	24	0.10 ± 0.050	0.049
	Plutonium-239,240	3	0.017 ± 0.0030	0.013	24	0.018 ± 0.0032	0.0084
	Strontium-90	3	0.015 ± 0.0072	0.0095	24	0.025 ± 0.0068	0.014
	Uranium-235	3	0.14 ± 0.086	0.10	24	0.32 ± 0.17	0.073
	Uranium-238	3	1.4 ± 0.50	1.2	24	2.2 ± 0.71	0.94

Table A.5. (contd)

Location	Radionuclide	1997			1992-1996		
		No. of Samples	Concentration, pCi/g		No. of Samples	Concentration, pCi/g	
			Maximum ^(a)	Median ^(b)		Maximum ^(a)	Median ^(b)
Richland	Cobalt-60	1	0.035 ± 0.012		5	0.074 ± 0.019	0.051
	Cesium-137	1	0.22 ± 0.032		5	0.36 ± 0.050	0.31
	Europium-155	1	0.062 ± 0.030		5	0.077 ± 0.045	0.059
	Plutonium-239,240	1	0.0034 ± 0.00073		5	0.0023 ± 0.00077	0.0020
	Strontium-90	1	0.0043 ± 0.0029		5	0.0050 ± 0.0035	0.0023
	Uranium-235	1	0.053 ± 0.074		5	0.14 ± 0.080	0.068
	Uranium-238	1	0.83 ± 0.28		5	2.1 ± 0.54	1.2
White Bluffs Slough	Cobalt-60	1	0.029 ± 0.012		6	0.20 ± 0.031	0.093
	Cesium-137	1	0.53 ± 0.059		6	0.97 ± 0.11	0.82
	Europium-155	1	0.052 ± 0.031		6	0.065 ± 0.034	0.049
	Plutonium-239,240	1	0.0039 ± 0.00089		6	0.0073 ± 0.0017	0.0041
	Strontium-90	1	0.0050 ± 0.0035		6	0.017 ± 0.0055	0.0072
	Uranium-235	1	-0.0034 ± 0.073		6	0.15 ± 0.12	0.036
	Uranium-238	1	1.0 ± 0.36		6	1.9 ± 0.52	1.2
Riverbank Spring Sediment							
100-B Spring	Cobalt-60	1	0.051 ± 0.024		2	0.029 ± 0.0097	0.020
	Cesium-137	1	0.079 ± 0.032		2	0.095 ± 0.015	0.060
	Europium-155	1	0.043 ± 0.070		2	0.074 ± 0.036	0.069
	Strontium-90	1	0.0014 ± 0.0032		2	0.0041 ± 0.0050	0.0034
	Uranium-235	1	0.20 ± 0.10		2	0.10 ± 0.080	0.042
	Uranium-238	1	1.2 ± 0.40		2	1.2 ± 0.38	1.2
100-F Spring	Cobalt-60	1	0.044 ± 0.024		2	0.040 ± 0.015	0.022
	Cesium-137	1	0.12 ± 0.040		2	0.32 ± 0.040	0.26
	Europium-155	1	0.030 ± 0.067		2	0.055 ± 0.031	0.046
	Strontium-90	1	0.0087 ± 0.0069		2	0.0096 ± 0.010	0.0070
	Uranium-235	1	0.083 ± 0.11		2	0.17 ± 0.13	0.17
	Uranium-238	1	0.97 ± 0.43		2	1.4 ± 0.54	1.3

Table A.5. (contd)

Location	Radionuclide	1997			1992-1996		
		No. of Samples	Concentration, pCi/g Maximum ^(a)	Median ^(b)	No. of Samples	Concentration, pCi/g Maximum ^(a)	Median ^(b)
100-K Spring	Cobalt-60	1	0.015 ± 0.021		1	0.0073 ± 0.020	
	Cesium-137	1	0.19 ± 0.046		1	0.15 ± 0.047	
	Europium-155	1	0.039 ± 0.047		1	0.13 ± 0.066	
	Strontium-90	1	0.0085 ± 0.0048		1	0.0012 ± 0.0046	
	Uranium-235	1	0.14 ± 0.065		1	0.20 ± 0.14	
	Uranium-238	1	0.82 ± 0.24		1	1.5 ± 0.54	
300 Area Spring	Cobalt-60	1	0.013 ± 0.019		4	0.016 ± 0.0076	0.0093
	Cesium-137	1	0.077 ± 0.042		4	0.15 ± 0.026	0.072
	Europium-155	1	0.034 ± 0.060		4	0.13 ± 0.14	0.055
	Strontium-90	1	0.0055 ± 0.0056		4	0.012 ± 0.0060	0.0075
	Uranium-235	1	0.19 ± 0.11		4	0.41 ± 0.16	0.098
	Uranium-238	1	2.0 ± 0.58		4	5.2 ± 1.1	3.7
Hanford Spring	Cobalt-60	1	0.049 ± 0.029		4	0.090 ± 0.021	0.072
	Cesium-137	1	0.25 ± 0.058		4	0.29 ± 0.032	0.22
	Europium-155	1	0.066 ± 0.063		4	0.068 ± 0.034	0.061
	Strontium-90	1	0.0057 ± 0.0039		4	0.0086 ± 0.011	0.0074
	Uranium-235	1	0.17 ± 0.11		4	0.23 ± 0.14	0.024
	Uranium-238	1	1.6 ± 0.56		4	1.9 ± 0.54	1.1

(a) Values are ± total propagated analytical uncertainty (2-sigma).

(b) Median values are not provided when only one sample analyzed.

Table A.6. Median Metal Concentrations (mg/kg dry wt.) in Columbia River Sediment, 1997

Metal	Priest Rapids Dam	Hanford Reach ^(a)	McNary Dam	Riverbank Springs ^(b)
Antimony	0.80	0.70	0.85	0.63
Arsenic	6.9	5.3	8.1	5.1
Beryllium	1.1	1.2	1.4	1.4
Cadmium	4.3	0.99	1.9	0.92
Chromium	68	55	67	70
Copper	39	19	35	21
Lead	36	31	26	23
Nickel	36	19	30	21
Selenium	0.12	<1.8	0.18	<1.6
Silver	0.34	0.25	0.41	0.068
Thalium	1.5	0.73	0.76	0.58
Zinc	450	220	260	230

(a) 100-F Slough, Hanford Slough, Richland, and White Bluffs Slough.

(b) 100-B, 100-D, 100-F, 100-H, 100-K, 100-N, Old Hanford Townsite, and 300 Area.

Table A.7. Radionuclide Concentrations Measured in Riverbank Spring Water, 1997 Compared to Previous 5 Years

Location/Radionuclide	1997			1992-1996			Washington State Ambient Surface Water Quality Standard, ^(b) pCi/L
	No. of Samples	Concentration, ^(a) pCi/L	Maximum	No. of Samples	Concentration, ^(a) pCi/L	Maximum	
100-B Spring							
Alpha (gross)	1	1.2 ± 0.89		6	3.5 ± 1.8	1.6	15
Beta (gross)	1	6.6 ± 1.9		6	38 ± 4.6	10	50
Strontium-90	1	0.024 ± 0.030		6	0.072 ± 0.11	0.023	8
Technetium-99	1	5.8 ± 1.1		6	25 ± 3.2	14	900 ^(c)
Tritium	1	11,000 ± 910		6	24,000 ± 1,800	14,000	20,000
100-D Spring							
Alpha (gross)	1	0.86 ± 0.60		7	2.9 ± 1.9	1.3	15
Beta (gross)	1	2.1 ± 1.6		7	21 ± 3.3	9.3	50
Strontium-90	1	1.7 ± 0.33		7	9.4 ± 1.8	4.3	8
Tritium	1	360 ± 160		7	12,000 ± 1,000	6,500	20,000
100-F Spring							
Alpha (gross)	1	3.1 ± 1.3		3	41 ± 18	3.7	15
Beta (gross)	1	3.8 ± 1.8		3	65 ± 11	2.0	50
Strontium-90	1	0.034 ± 0.033		3	0.099 ± 0.091	0.094	8
Tritium	1	1,100 ± 210		3	1,800 ± 240	1,600	20,000
Uranium (total)	1	4.6 ± 0.59		3	9.2 ± 1.2	4.6	-- ^(d)
100-H Spring							
Alpha (gross)	1	2.4 ± 1.0		5	4.6 ± 1.9	4.4	15
Beta (gross)	1	33 ± 4.2		5	69 ± 7.0	60	50
Strontium-90	1	17 ± 3.1		5	25 ± 4.5	17	8
Technetium-99	1	18 ± 2.4		5	140 ± 15	110	900
Tritium	1	430 ± 170		5	1,200 ± 240	1,100	20,000
Uranium (total)	1	1.7 ± 0.25		5	8.4 ± 1.2	6.6	--
100-K Spring							
Alpha (gross)	1	0.56 ± 0.51		3	1.6 ± 1.2	1.4	15
Beta (gross)	1	1.4 ± 1.4		3	3.6 ± 2.5	2.7	50
Strontium-90	1	0.59 ± 0.13		3	0.11 ± 0.13	-0.024	8
Tritium	1	110 ± 140		3	20,000 ± 1,500	18,000	20,000

Table A.7. (contd)

Location/Radionuclide	No. of Samples	1997		1992-1996		Washington State Ambient Surface Water Quality Standard, ^(b) pCi/L		
		Concentration, ^(a) pCi/L	Maximum	Concentration, ^(a) pCi/L	Maximum			
100-N Spring^(e)								
Alpha (gross)	2		2.8 ± 1.2		6	8.9 ± 14	1.6	15
Beta (gross)	2		16,000 ± 1,400		6	24,000 ± 1,700	4.5	50
Strontium-90	2		9,900 ± 1,800		6	11,000 ± 2,000	0.066	8
Tritium	2		19,000 ± 1,500		6	31,000 ± 2,400	23,000	20,000
300 Area Spring								
Alpha (gross)	1		45 ± 8.2		7	110 ± 21	54	15
Beta (gross)	1		7.6 ± 2.0		7	29 ± 4.7	16	50
Iodine-129	1		0.0055 ± 0.00058		4	0.0049 ± 0.00063	0.0033	1
Technetium-99	1		8.8 ± 1.4		6	14 ± 1.9	5.3	900 ^(c)
Tritium	1		7,900 ± 680		7	12,000 ± 940	9,800	20,000
Uranium (total)	1		53 ± 5.6		7	130 ± 12	87	--
Old Hanford Townsite Spring								
Alpha (gross)	1		0.10 ± 0.38		7	4.9 ± 2.2	3.0	15
Beta (gross)	1		18 ± 2.9		7	95 ± 140	18	50
Iodine-129	1		0.14 ± 0.0081		5	0.22 ± 0.014	0.086	1
Technetium-99	1		43 ± 5.1		7	130 ± 16	54	900 ^(c)
Tritium	1		56,000 ± 4,200		7	170,000 ± 13,000	120,000	20,000
Uranium (total)	1		2.0 ± 0.31		6	4.3 ± 0.52	2.6	--

(a) Maximum values are ± total propagated analytical uncertainty (2-sigma).

(b) WAC 246-290, 40 CFR 141, and Appendix C, Table C.2.

(c) WAC 173-201A-050 and EPA-570/9-76-003.

(d) Dashes indicate no concentration guides available.

(e) 1992 sample is from well 199-N-46, 1993-1997 samples are from shoreline spring. In 1997, two samples were collected; one below well 199-N-8T and one at the 1993-1996 spring location.

Table A.8. Average Metal Concentrations ($\mu\text{g/g}$ dry wt.) in Livers of Hanford Reach Fish, 1997

	100 Areas				Old Hanford Townsite			300 Area			Vernita Bridge
	Bass	Carp	Sculpin	Sucker	Bass	Carp	Sucker	Bass	Carp	Sucker	Sculpin
Antimony	0.071	0.058	0.015	0.018	0.032	0.048	0.051	0.022	0.054	0.051	0.024
Arsenic	0.45	0.59	0.50	0.82	0.56	0.93	0.52	0.36	0.52	0.34	0.56
Cadmium	2.19	47.	8.1	0.067	4.4	21.	2.8	1.5	59.	0.11	6.34
Chromium	0.21	0.30	0.29	0.23	0.21	0.38	0.23	0.20	0.35	0.20	0.37
Copper	8.8	110.	20.	5.6	17.	87.	14.	6.2	116.	4.6	14.
Mercury	0.40	0.24	0.29	0.23	0.35	0.18	0.37	0.36	0.30	0.52	0.17
Nickel	0.055	0.14	0.26	0.370	0.050	0.26	0.26	0.030	0.13	0.15	0.14
Lead	0.44	0.83	0.20	0.048	0.037	0.37	0.14	0.036	0.67	0.036	0.20
Selenium	7.5	4.9	6.1	1.3	9.3	4.7	2.3	6.8	5.4	1.2	5.8
Silver	0.045	1.1	0.045	0.045	0.058	0.70	0.055	0.045	1.2	0.045	0.045
Thallium	0.27	0.12	0.23	0.098	0.38	0.165	0.078	0.33	0.13	0.081	0.35
Zinc	77.	1000.	146.	30.	81.	790.	41.	62.	980.	19.	150.

Table A.9. Average Metal Concentrations ($\mu\text{g/g}$ dry wt.) in Kidneys of Hanford Reach Fish, 1997

	100 Areas			Old Hanford Townsite			300 Area			
	Bass	Carp	Sucker	Bass	Carp	Sucker	Bass	Carp	Sucker	
Antimony	0.027	0.040	0.065	0.021	0.061	0.016	0.015	0.016	0.015	
Arsenic	0.40	0.98	0.95	0.50	1.4	0.82	0.48	1.1	0.49	
Cadmium	0.59	190.	12.	1.0	73.	36.	0.90	170.	35.	
Chromium	0.25	0.31	0.280	0.22	0.31	0.43	0.40	0.42	0.64	
Copper	4.54	11.	4.0	5.4	8.8	5.4	6.6	12.	6.1	
Mercury	0.22	0.58	0.11	0.20	0.40	0.29	0.25	0.54	0.30	
Nickel	0.21	0.95	1.2	0.16	1.0	3.2	0.18	1.72	4.1	
Lead	0.36	2.7	0.25	0.11	1.1	0.25	0.089	1.5	0.34	
Selenium	6.3	8.1	2.9	5.7	6.9	4.7	6.4	8.0	5.5	
Silver	0.045	0.098	0.045	0.045	0.059	0.047	0.045	0.11	0.045	
Thallium	0.19	0.54	0.072	0.16	0.46	0.067	0.19	0.48	0.081	
Zinc	89.	920.	85.	58.	830.	190.	69.	1100.	130.	

References

40 CFR 141, U.S. Environmental Protection Agency, "National Primary Drinking Water Regulations; Radio-nuclides; Proposed Rule." *Code of Federal Regulations*.

PNNL-11796. 1998. *Hanford Site Environmental Data for Calendar Year 1997*. L. E. Bisping, Pacific Northwest National Laboratory, Richland, Washington.

EPA-570/9-76-003. 1976. *National Interim Primary Drinking Water Regulations*. Office of Water Supply, U.S. Environmental Protection Agency, Washington, D.C.

Washington Administrative Code (WAC) 246-290, *Group A Public Water Systems*.

Washington Administrative Code (WAC) 173-201A, *Water Quality Standards for Surface Waters of the State of Washington*.